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IS 5905 (1989): Sprayed aluminium and zinc coatings on iron and steel [MTD 7: Light Metals and their Alloys]



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“REAFFIRMED 1993”

IS 5905 : 1989

Indian Standard

**SPRAYED ALUMINIUM AND ZINC
COATINGS ON IRON AND STEEL —
SPECIFICATION**

(First Revision)

भारतीय मानक

**लोह और इस्पात पर एलुमिनियम और जस्ता के फुहारित
लेपनों की — विशिष्टि**

(पहला पुनरीक्षण)

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FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards on 10 August 1989, after the draft finalized by the Hot Dip Sprayed and Diffusion Coatings Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first issued in 1970. This revision has been prepared keeping in view the rapid advances with regard to the procedure and applications of metal spraying during the past decade.

Iron and steel parts and structures can be protected against corrosion by spraying them with non-ferrous metallic coatings. Aluminium and zinc are the most commonly used metals for this purpose. They are anodic to steels and hence protect the base metal against corrosion even when the coating is imperfect or slightly damaged. They also have better abrasion resistance than paints. The metals are normally sprayed on to the iron and steel after suitable surface preparation.

Aluminium or zinc in the form of powder or wire is fed into suitably designed spraying gun or torch, where it is melted by a heat source. The heat source is generally an oxy-gas fuel flame or electric arc. The molten metal is then atomised and propelled at high velocity by a blast of compressed air on to the surface to be sprayed, when it gets flattened and firmly adheres to it.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2:1960 'Rules for rounding off numerical values (revised)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

SPRAYED ALUMINIUM AND ZINC COATINGS ON IRON AND STEEL — SPECIFICATION

(*First Revision*)

1 SCOPE

1.1 This standard applies to sprayed coatings of aluminium or zinc used for protection of iron and steel against atmospheric corrosion under all climatic conditions.

2 REFERENCES

2.1 The following Indian Standards are necessary adjuncts to this standard:

IS No.	Title
IS 209 : 1979	Specification for zinc (<i>third revision</i>)
IS 1501 (Part 1) : 1984	Method for Vickers hardness test for metallic materials: Part 1 HV 5 to HV 100 (<i>second revision</i>)
IS 2590 : 1987	Specification for primary aluminium ingots for remelting for general engineering purposes (<i>second revision</i>)
IS 3203 : 1982	Methods of testing local thickness of electroplated coatings (<i>first revision</i>)
IS 4683 : 1968	Specification for chilled iron shot and grit for use in foundries
IS 6586 : 1989	Metal Spraying for protection of iron and steel practice — Recommended (<i>first revision</i>)
IS 9954 : 1981	Pictorial surface preparation standards for painting of steel surfaces

3 RECOMMENDED PROTECTIVE SCHEME

3.1 Basis of Recommendation

When selecting the appropriate grade of protection as given in 3.2, attention should be given to the nature and severity of exposure conditions, nature of the structure, its utility,

expected life and maintenance schedule. It is rather difficult to recommend unequivocally the best system for a particular situation. At best, systems which are expected to give a reasonably good performance may be suggested. The user has to select the best combination of the protective scheme depending on the recommendations given in this standard, his own accumulated experience and overall economics.

3.2 Recommended Scheme

Taking into consideration the various factors, this standard broadly classifies the exposure environments into nine categories (*see* Table 1) and recommends 2 Grades of protective schemes as follows, to suit the anticipated life. They represent the minimum acceptable standard of good practice and should prove to be economical in the long range use.

a) Grade A Scheme

This scheme applies to coatings which give a minimum protection of 20 years.

b) Grade B Scheme

This scheme applies to coatings which give a minimum protection of 10 years.

NOTE — The period of the first maintenance to the protective coating and subsequent periodic maintenance to be decided on the state of top coat.

4 SURFACE PREPARATION

4.1 The surface shall be thoroughly cleaned and roughened by compressed air blasting or centrifugal blasting with a suitable abrasive grit. Immediately before spraying it shall be free from grease, scale, rust, moisture or other foreign matter. The grade of blasting shall conform to IS 9954 : 1981. Its roughness shall be comparable with a reference surface produced in accordance with Annex A and shall provide an adequate key for the subsequently sprayed metal coating.

4.2 Where the preparation results in a surface texture which cannot be compared with a reference standard produced in accordance with Annex A, the criterion of acceptability shall be as agreed to between the purchaser and the manufacturer on the basis of the adhesion test specified in 6.5.

Table 1 Recommended Nominal Coating Thickness for Grade A and Grade B Schemes for Various Requirements*(Clauses 3.2 and 6.4)*

Sl No.	Environment	Nominal Coating Thickness (in Micrometer) for Varying Services			
		Very long (More than 20 years) with sealers* μm	Long (10 to 20 years)		
			With Sealers* μm	With Paint	
(1)	(2)	(3)	(4)	(5) Metal Coating	(6) Paint Coating
1	Exterior-exposed inland or rural non-polluted	150 Zn 100 Al	100 Zn —	100 Al or Zn	30 to 100
2	Exterior-exposed inland or rural polluted (industrial)	150 Al 150 Zn	100 Al 100 Zn	100 Al or Zn	60 to 100
3	Exterior-exposed marine or coastal non-polluted	150 Zn 150 Al	100 Zn 100 Al	100 Al or Zn	30 to 100
4	Exterior-exposed marine or coastal-polluted	150 Al 250 Zn	100 Al 150 Zn	100 Al or Zn	30 to 100
5	Interior and/or sheltered normally dry	—	—	100 Al or Zn	30 to 100
6	Interior and/or sheltered but frequently wet	100 Zn 100 Al	—	100 Al or Zn	30 to 100
7	Sea water immersed	250 Zn 150 Al	150 Zn —	100 Al or Zn	60 to 100
8	Sea water splash	250 Zn 150 Al	175 Zn —	100 Al or Zn	60 to 100
9	Non-saline or potable water	150 Zn 150 Al	150 Zn 100 Al	100 Al or Zn	30 to 100

*Suitable sealer compatible with the material should be used. The use of a primer with sealer is optional.

Zn — Zinc

Al — Aluminium

5 SPRAYING

5.1 The metal spraying shall be carried out without delay after the surface has been prepared by suitable grit blasting, but in any case within such period that the metal is sprayed into a surface which is still completely clean, dry and without visible oxidation. If deterioration in the surface to be sprayed is observed, by comparison with a freshly prepared metal surface of similar quality which has undergone the same preparation, the preparation treatment shall be repeated on the surface to be sprayed. As far as practicable, the spraying may be carried out in accordance with IS 6586 : 1989.

6 COATING REQUIREMENTS

6.1 The sprayed metal coating on components shall meet the following requirements.

NOTE — Under the environmental conditions having pH values between 6 to 11.5, zinc coating may be applied and in case of pH values less than 6, aluminium coating is recommended.

6.2 Purity of the Metal

6.2.1 Aluminium

The chemical composition of aluminium to be sprayed shall be 99.5 percent aluminium con-

forming to IS 2590 : 1979. Alternately, 99.0 percent aluminium conforming to IS 2590 : 1979 may be used if agreed to by the purchaser.

6.2.2 Zinc

The chemical composition of zinc to be sprayed shall conform to grade 99.95 percent of IS 209 : 1979.

6.3 Appearance

The surface of the sprayed coating should be of uniform texture and free from lumps, coarse areas and loosely adherent material. It should not show any sign of degradation and should include no blisters or embedded foreign matter.

6.4 Thickness of the Coating

Nominal thickness of the coating for the selected scheme as specified in Table 1 shall be adhered to. The minimum local thickness at any point shall not be less than 75 percent of the specified nominal thickness.

6.4.1 The measurement of thickness shall be made by magnetic method described in IS 3203 : 1982.

6.5 Adhesion

The sprayed metal coating shall be subjected to an adhesion test either by the scribing method as given in 6.5.1 or by grid method as given in 6.5.2. If any part of the coating between the lines or grids breaks away from the basis surface, it shall be deemed to have failed the test. The item or areas selected for this test shall be agreed to between the manufacturer and the purchaser.

6.5.1 Scribe Method of Test for Adhesion

Using a straight edge and a hardened steel scriber which has been ground to a sharp 30° point, scribe two parallel lines at a distance apart equal to approximately ten times the average coating thickness. In scribing the two lines, apply enough pressure on each occasion to cut through the coating to the basis metal in the minimum number of strokes.

6.5.2 Grid Test for Adhesion

Using the tool defined as above and cut a lattice of the following dimensions as described

in 6.4.1.

Thickness of Coating Varified (μm)	Distance Between Cuts (mm)	Approximate Surface to be Covered by the Lattice (mm^2)
Up to 200	3	15 × 15
Over 200	5	25 × 25

7 RETREATMENT OF DEFECTIVE AREAS

7.1 Any defective area shall be cleaned of all sprayed metal by blasting or other suitable mean and re-prepared to conform to the requirement of 4, prior to respraying. Where the defect has been solely due to too thin a coating, sprayed metal of the same quality may be added, provided that the surface has been kept dry and is free from visible contamination.

8 ADDITIONAL PROTECTIVE MEASURES

8.1 Sealing and finishing coats wherever applied on zinc and aluminium to provide additional protection should be applied without delay. Contamination of the sprayed surface with oil, grease, dirt, finger marks, etc shall be avoided.

ANNEX A

(Clause 4.1)

METHOD OF PREPARATION OF REFERENCE SURFACE FOR COMPARISON

A-1 BASE METAL

A-1.1 A flat piece of medium or low carbon steel not less than 6 mm thick, having a Vickers hardness of 180 to 220 HV 10, when tested in accordance with IS 1501 (Part 1) : 1984.

A-2 ABRASIVE

A-2.1 Chilled iron grit of sizes G-C 100 to G-C 42 in accordance with IS 4683 : 1968 is suitable.

A-3 GRIT BLASTING EQUIPMENT

A-3.1 Any suitable direct-pressure equipment, such that the air pressure is 3 kg/cm² to 4 kg/cm² at the pressure grit container, the blast hose

being not more than 4.5 m long and of diameter not less than three times the nozzle diameter, is suitable.

A-4 PROCEDURE

A-4.1 Grit-blast with the blasting nozzle approximately at right angles to and 250 mm from the surface, until a uniformly rough, clean surface not less than 2 500 mm² in area, has been obtained and maintained without visible change for at least 25 percent of the total blasting time and preserved in that condition.

NOTE — The blasting conditions given in this annex are not necessarily those for blasting the actual work.

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